

GENERAL DYNAMICS

Armament Systems

Advanced Turreted Gun Systems for All-Composite Aircraft RAH-66 & MV-22



Ed De Pasqual

***Systems Weaponization Engineering
General Dynamics Armament Systems
Burlington, Vermont USA***



36th Gun & Ammunition Symposium & Exhibition
San Diego, California

##

Agenda

- Advanced Composite Aircraft Programs
- ACAP Test Program Conclusions
- Conventional Turret Approaches
- RAH-66 and MV-22 Turret Integration
- Summary

AATD Composite Aircraft Program

- Bell Helicopter D292 ACAP
- Sikorsky Aircraft S-75 ACAP



Bell Helicopter's D292 ACAP



- Program Plan

- Crashworthiness
- Static Testing
- Repairability

- Armament Testing

- None

Sikorsky Aircraft S-75 ACAP



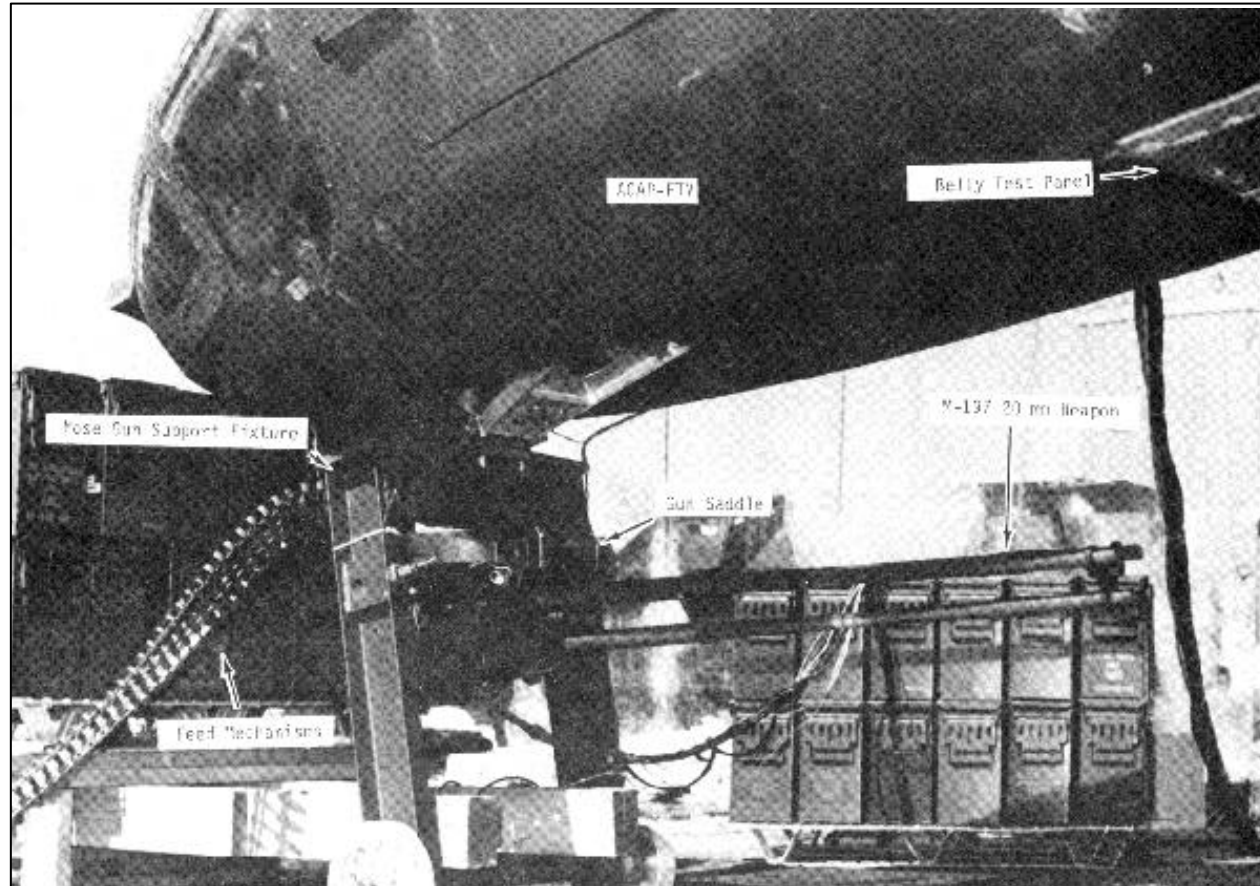
- Program Plan

- Crashworthiness
- Ballistic Tolerance
- Reduced Signature

- Armament Testing

- Turret Interface
- Weapons Effects

Turret Testing on S-75 Burlington, VT



ACAP Weapon Testing Conclusions

- Landing Gear Trunion Hard Points Provide Most Suitable Turret Structure Load Path
- The Composite Structure Affords Very Good Damping Characteristics for Recoil Loads
- Composite Materials/Design Are Tailorable for a Range of Damping Coefficients
- Localized Vibratory Modes can be Critical

Weapons Testing Conclusions (Con't)

- Localized Areas with Natural Frequencies Near the Gun Firing Frequency can be Often Easily Overstressed.
- Bottom Line:
 - Design a Stiff Turret with a High Natural Frequency
 - Design Supporting Structure with Simple and Direct Load Paths

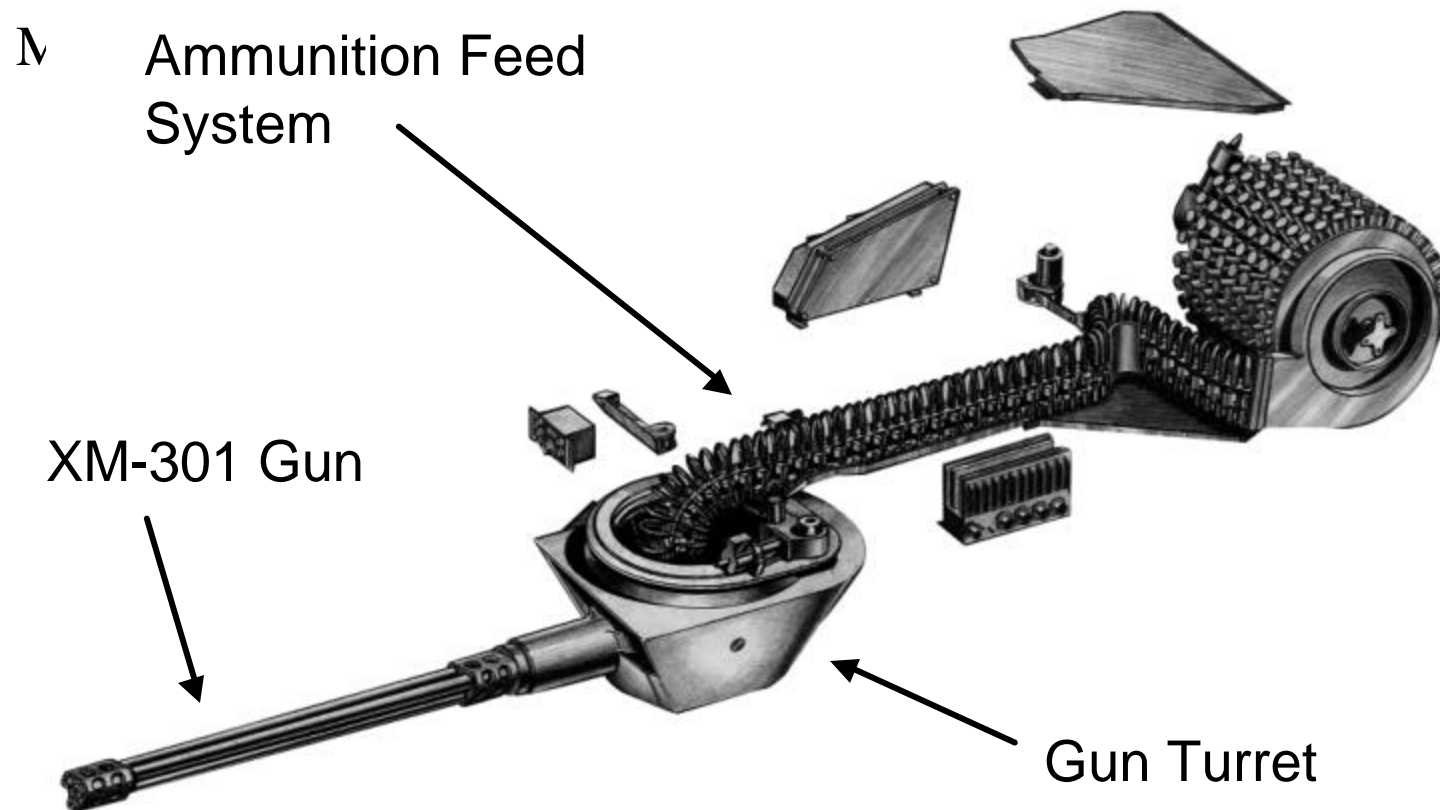
Turreted Gun Interface - The Conventional Approach



GDAS R&D Composite Study Turret



RAH-66 Turreted Gun System

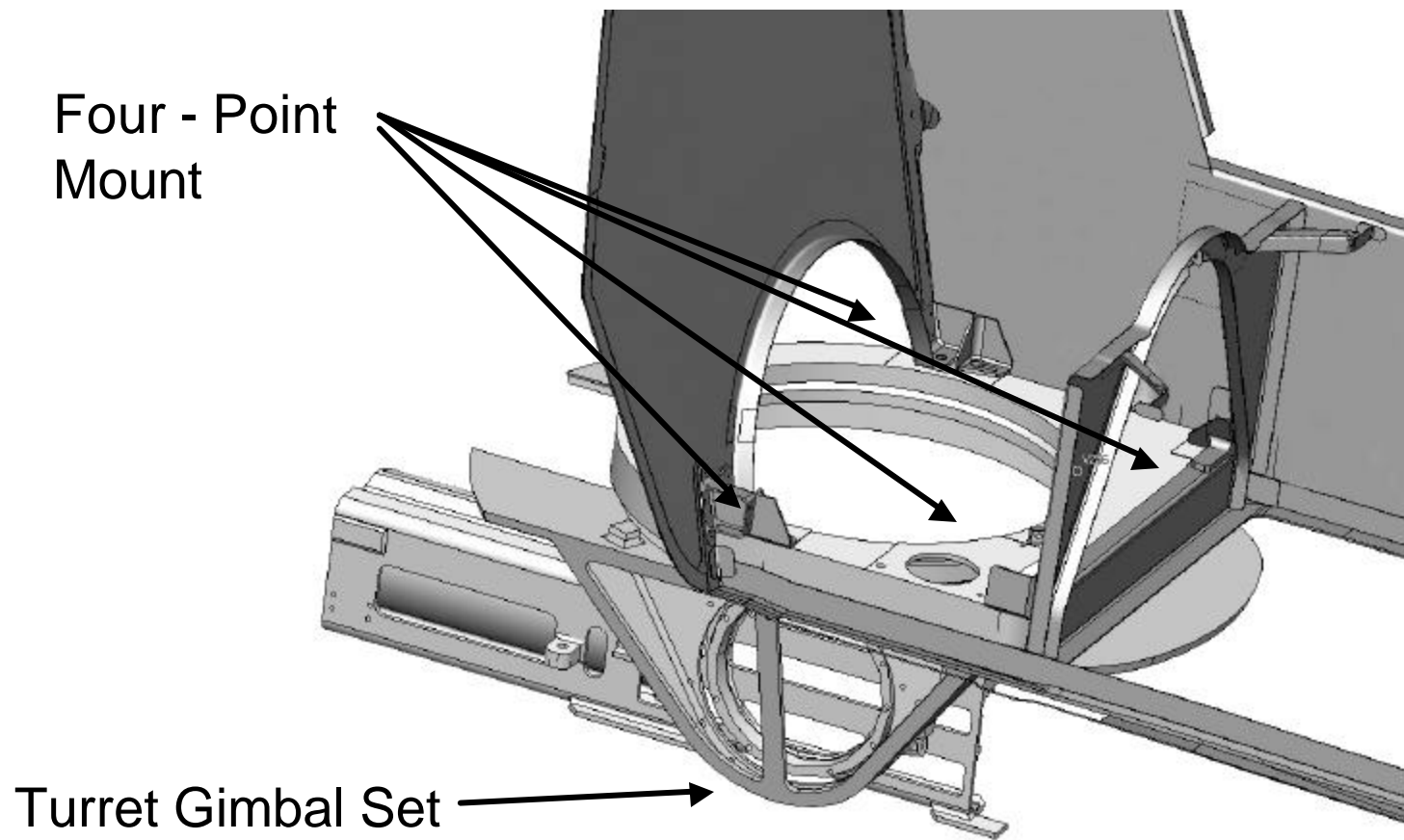


RAH-66 Gun Turret Configuration

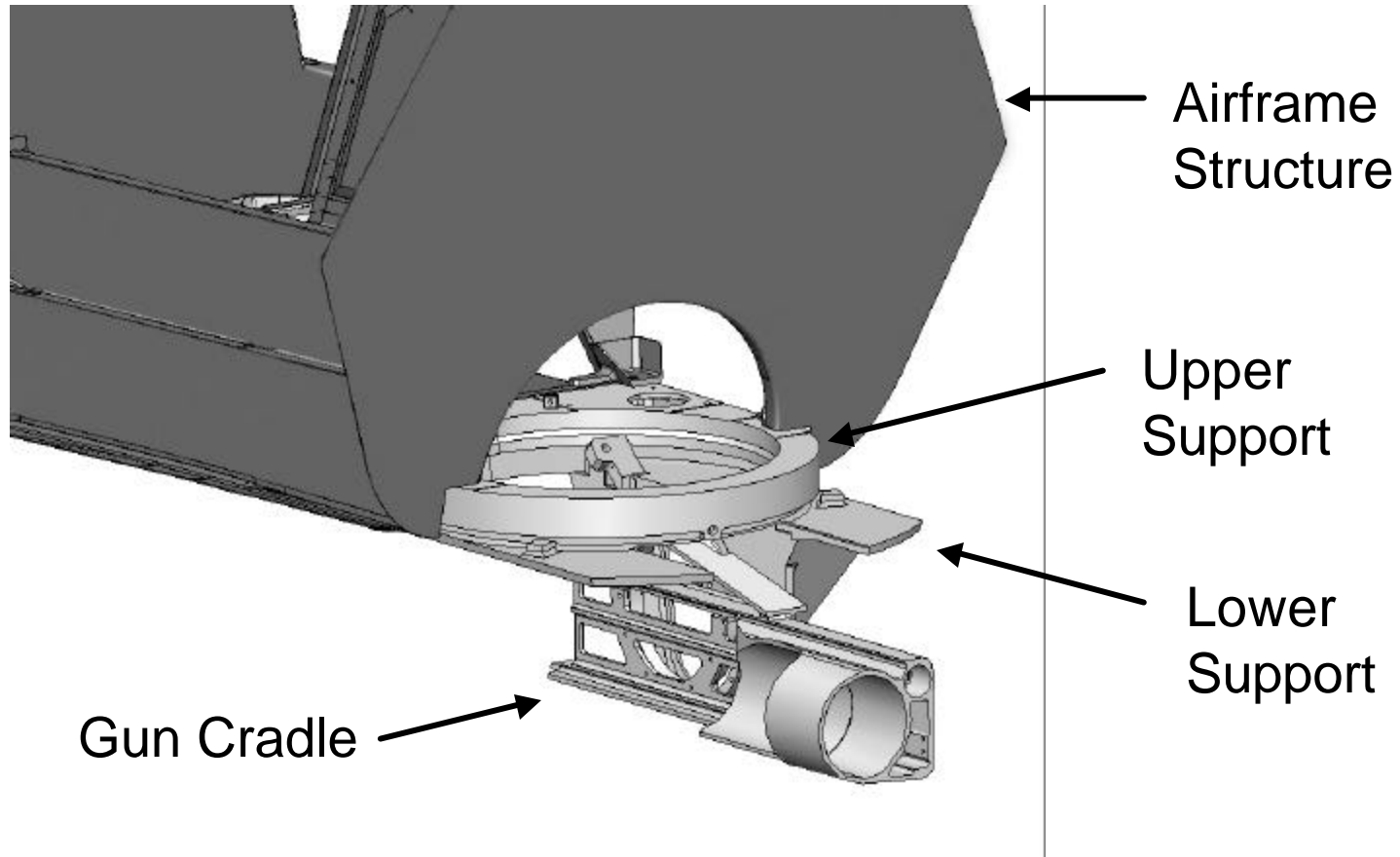
- Conventional Turret/Aircraft Type Interface
- Composite Materials Supporting Structures



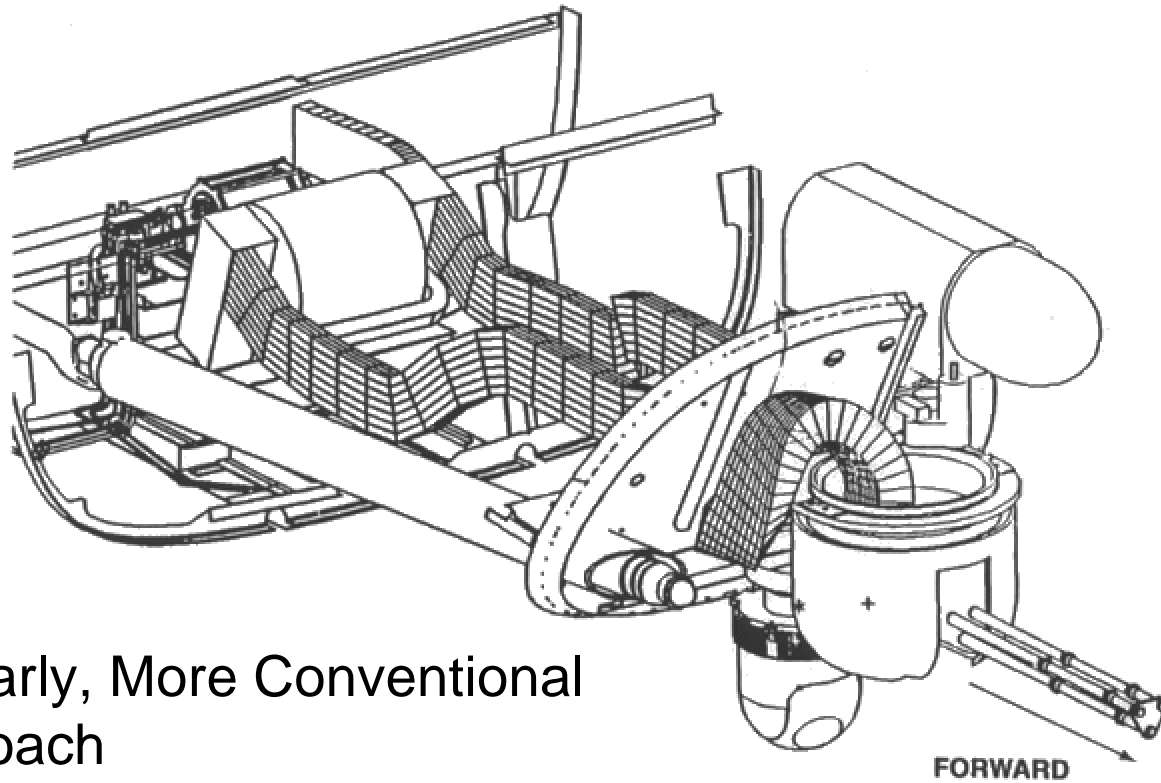
RAH-66 Comanche Turret Interface



RAH-66 Comanche Turret Interface

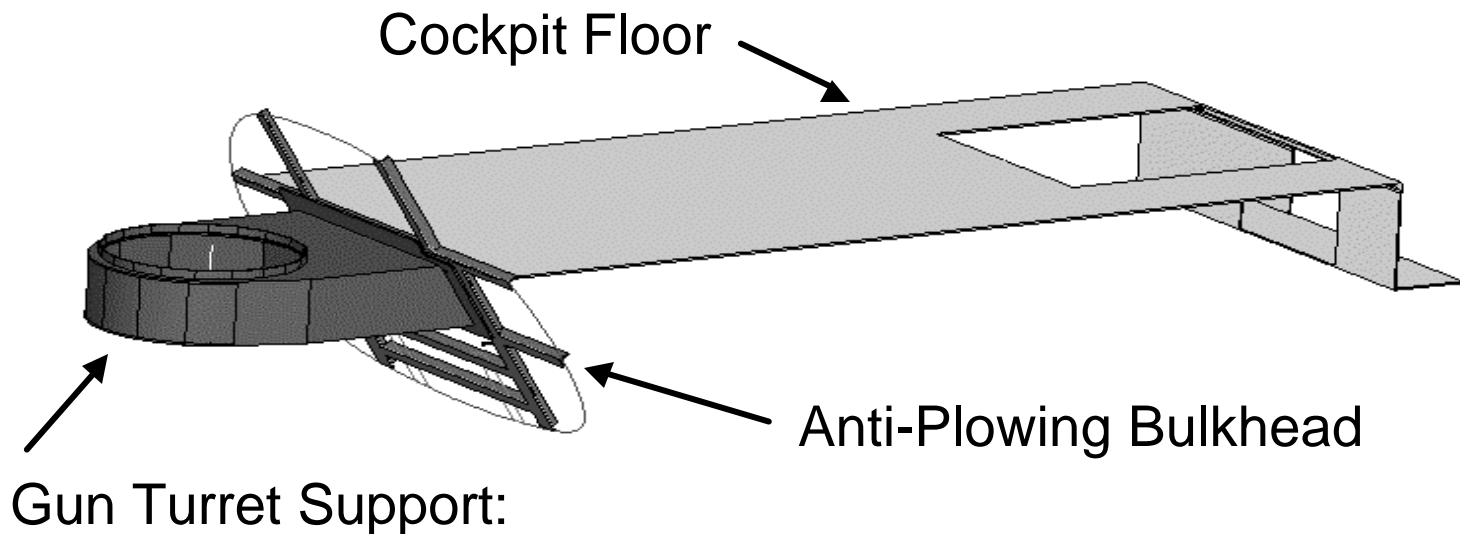


CV-22 Definition Trade Study



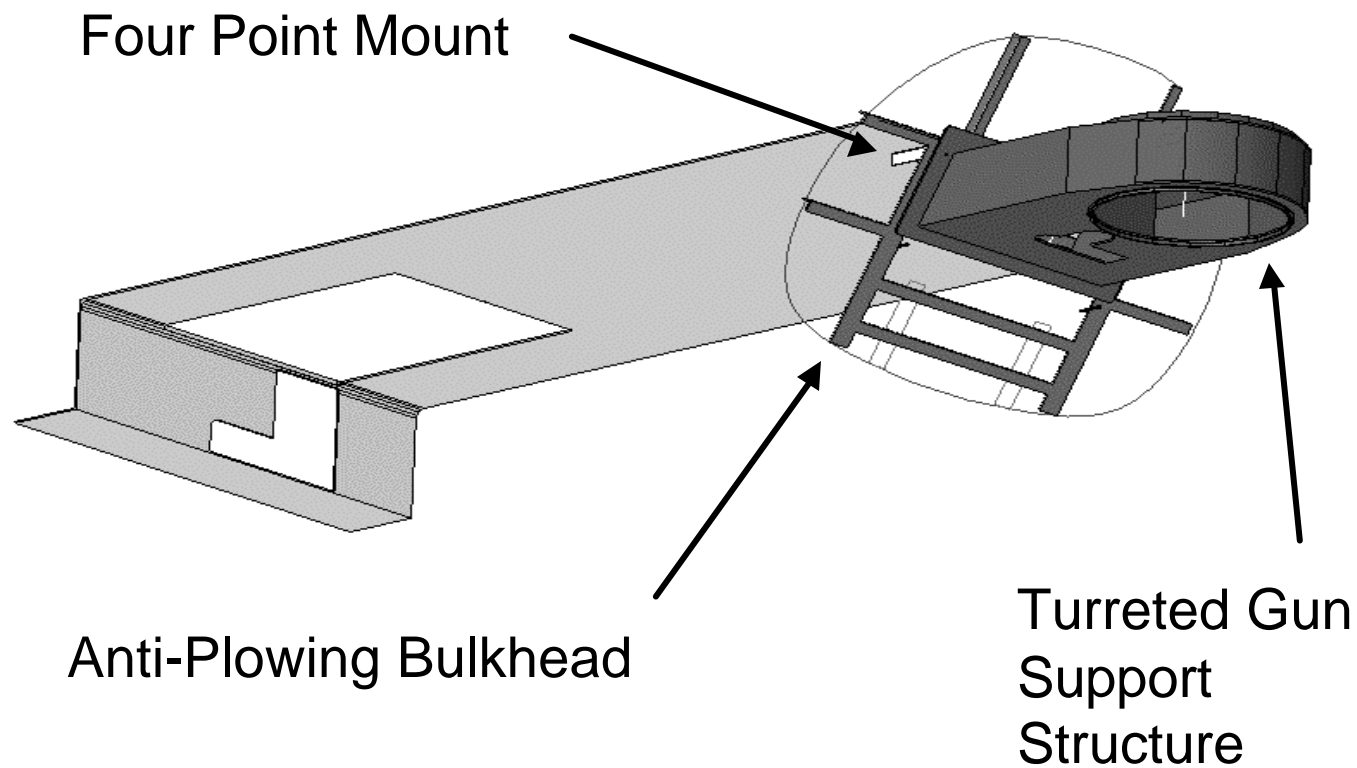
An Early, More Conventional
Approach

A New Approach for the MV-22



- a) It functions as the upper portion of the turret,
- b) and the forward portion of the ammunition feed system.
- c) It eliminates the weight of a separate support structure

A New Approach for the MV-22



MV-22 Turreted Gun System



- Fully Integrated Approach
- Significant Weight Savings (> 50 lbs.)
- Simplifies Aircraft Nose Redesign
- Compatible With Crashworthiness Design